

I CLAIM:

1. In a toilet room flush valve for use in flushing toilets and urinals including a valve body having a water inlet and a water outlet, valve means within the body for controlling flow between the inlet and outlet, and a valve handle pivotally mounted on the valve body for movement to operate the valve means, the improvement comprising an actuator for causing movement of the valve handle, the actuator comprising:

a housing mountable on the valve body, a handle assembly pivotally mounted to the housing, a push rod mounted for movement with the handle assembly and relative to the handle assembly, the push rod being positioned to be engageable with the valve handle, a drive motor mounted to the handle assembly and connected to the push rod to cause movement thereof, a power supply for operating the drive motor, and a sensor associated with the actuator and connected to the power supply to cause the application of power to the drive motor.

2. The actuator of claim 1 wherein the handle assembly is engageable with the valve handle for causing pivotal movement of the handle independent of the push rod.

3. The actuator of claim 2 wherein the handle assembly includes a handle interface which engages the valve handle when the drive motor is not activated.

4. The actuator of claim 3 wherein the push rod has some slack between the valve handle and the drive motor when the drive motor is not activated.

5. The actuator of claim 1 wherein the push rod has some slack between the valve handle and the drive motor when the drive motor is not activated.

6. The actuator of claim 1 wherein the housing comprises a front cover, a rear cover and a handle collar, the handle collar being engageable with the valve body and the front and rear covers being fixed to the handle collar.

7. The actuator of claim 6 wherein the handle collar includes at least one torpedo tube, and one of the front and rear covers includes at least one pillar in telescoping engagement with the torpedo tube.

8. The actuator of claim 7 wherein the other of the front and rear covers includes at least one pillar in telescoping engagement with the torpedo tube.

9. The actuator of claim 1 wherein the flush valve further comprises a handle mounting member surrounding the valve handle and having an end face which is in a plane generally perpendicular to the valve handle, and the housing further comprises a handle collar engageable with the end face of the handle mounting member, and a mounting strap releasably connected to the housing and engageable with the valve body to clamp the housing to the end face of the handle mounting member.

10. The actuator of claim 9 wherein the handle mounting member is a handle socket.

11. The actuator of claim 10 wherein the handle socket includes a cup and the end face is a flange on one end of the cup, the handle collar further comprising a sleeve that fits over the cup and a flange that is engageable with the flange of the socket.

12. The actuator of claim 11 wherein the handle collar further comprises a flexible grommet.

13. The actuator of claim 1 wherein the handle assembly includes a case having a drive train compartment and an electronics compartment.

14. The actuator of claim 13 wherein the electronics compartment contains the sensor and is located such that when the actuator is mounted on a flush valve, the electronics compartment is closer to the valve body than the drive train compartment.

15. The actuator of claim 1 wherein the sensor is mounted on the handle assembly.

16. An actuator for operating the valve handle of a flush valve either manually or automatically, the actuator including a housing mountable on the valve body, a manually operable handle assembly pivotally mounted on the housing and engageable with the valve handle for pivoting the valve handle upon manual actuation of the handle assembly, a motor-driven push rod mounted on the handle assembly and positioned to contact and pivotally move the valve handle, a drive motor connected to the push rod to cause movement thereof, a power

supply for operating the drive motor, and a sensor electrically connected to the power supply for applying power to the drive motor to cause movement of the valve handle upon sensing a condition that calls for operation of the flush valve.

17. The actuator of claim 16 wherein the handle assembly includes a handle interface which engages the valve handle when the drive motor is not activated.

18. The actuator of claim 17 wherein the push rod has some slack between the valve handle and the drive motor when the drive motor is not activated.

19. The actuator of claim 16 wherein the push rod has some slack between the valve handle and the drive motor when the drive motor is not activated.

20. The actuator of claim 16 wherein the housing comprises a front cover, a rear cover and a handle collar, the handle collar being engageable with the valve body and the front and rear covers being fixed to the handle collar.

21. The actuator of claim 20 wherein the handle collar includes at least one torpedo tube, and one of the front and rear covers includes at least one pillar in telescoping engagement with the torpedo tube.

22. The actuator of claim 21 wherein the other of the front and rear covers includes at

least one pillar in telescoping engagement with the torpedo tube.

23. The actuator of claim 16 wherein the flush valve further comprises a handle mounting member surrounding the valve handle and having an end face which is in a plane generally perpendicular to the valve handle, and the housing further comprises a handle collar engageable with the end face of the handle mounting member, and a mounting strap releasably connected to the housing and engageable with the valve body to clamp the housing to the end face of the handle mounting member.

24. The actuator of claim 23 wherein the handle mounting member is a handle socket.

25. The actuator of claim 24 wherein the handle socket includes a cup and the end face is a flange on one end of the cup, the handle collar further comprising a sleeve that fits over the cup and a flange that is engageable with the flange of the socket.

26. The actuator of claim 25 wherein the handle collar further comprises a flexible grommet.

27. The actuator of claim 16 wherein the handle assembly includes a case having a drive train compartment and an electronics compartment.

28. The actuator of claim 27 wherein the electronics compartment contains the sensor

and is located such that when the actuator is mounted on a flush valve, the electronics compartment is closer to the valve body than the drive train compartment.

29. The actuator of claim 16 wherein the sensor is mounted on the handle assembly.

30. An actuator for a flush valve of the type having a valve handle for operating the flush valve, the actuator comprising:

a housing mountable on the valve body, a handle assembly pivotally mounted to the housing and having an interface engageable with the valve handle for manually operating the valve handle, a drive motor mounted on one of the housing or handle assembly, a push rod connected to the drive motor and positioned to have some slack between the valve handle and the drive motor when the drive motor is not activated and engageable with the valve handle when the drive motor is activated to cause movement of the valve handle, a power supply for operating the drive motor, and a sensor associated with the actuator and connected to the power supply to cause the application of power to the drive motor.

31. The actuator of claim 30 wherein the interface engages the valve handle when the drive motor is not activated.

32. An actuator for a flush valve of the type having a valve handle for operating the flush valve, the actuator comprising:

a housing mountable on the valve body, a handle assembly pivotally mounted to the

housing and having an interface engageable with the valve handle, a drive motor mounted on one of the housing or handle assembly, a push rod connected to the drive motor, the interface being positioned to contact the valve handle when the drive motor is not activated, user-initiated manual movement of the handle assembly causing movement of the interface and the valve handle, a power supply for operating the drive motor, and a sensor associated with the actuator and connected to the power supply to cause the application of power to the drive motor.

33. The actuator of claim 32 wherein the push rod has some slack between the valve handle and the drive motor when the drive motor is not activated.

34. An actuator for a flush valve of the type having a valve body and a valve handle for operating the flush valve, the actuator comprising:

a housing mountable on the valve body, a handle assembly pivotally mounted to the housing and engageable with the valve handle during user-initiated manual movement of the handle assembly, a motor-driven drive train mounted on the handle assembly and engageable with the valve handle, and a sensor associated with the actuator and selectively operating the drive train, the drive train being disengaged from the valve handle during manual movement of the handle assembly.

35. The actuator of claim 34 wherein the handle assembly includes an interface which is in contact with the valve handle when the drive train is not activated and the drive train

includes a push rod which has some slack between the valve handle and the drive motor when the drive train is not activated.

36. In a toilet room flush valve for use in flushing toilets and urinals including a valve body having a water inlet and a water outlet, valve means within the body for controlling flow between the inlet and outlet, and a valve handle pivotally mounted on the valve body for movement to operate the valve means, the improvement comprising an actuator for causing movement of the valve handle, the actuator comprising:

a housing mountable on the valve body, a drive train and sensor connected to the housing and engageable with the valve handle to cause movement of the valve handle upon sensing a condition that calls for operation of the flush valve, the housing including a front cover, a rear cover and a handle collar, the handle collar being engageable with the valve body and the front and rear covers having pillars that engage the handle collar.

37. The actuator of claim 36 wherein the handle collar includes at least one torpedo tube, and one of the front and rear covers includes at least one pillar in telescoping engagement with the torpedo tube.

38. The actuator of claim 36 wherein the handle collar includes at least one torpedo tube located between and in engagement with the pillars of the front and rear covers.

39. The actuator of claim 38 wherein the pillars are in telescoping engagement with

the torpedo tube.

40. The actuator of claim 36 wherein the flush valve further comprises a handle

mounting member surrounding the valve handle and having an end face which is in a plane generally perpendicular to the valve handle, and the handle collar is engageable with the end face of the handle mounting member, and the actuator further comprises a mounting strap releasably connected to the housing and engageable with the valve body to clamp the housing to the end face of the handle mounting member.

41. The actuator of claim 40 wherein the handle mounting member is a handle socket.

42. The actuator of claim 41 wherein the handle socket includes a cup and the end face is a flange on one end of the cup, the handle collar further comprising a sleeve that fits over the cup and a flange that is engageable with the flange of the socket.

43. The actuator of claim 42 wherein the handle collar further comprises a flexible grommet.

44. In a flush valve of the type having a valve body with a valve handle extending therefrom, the valve handle being attached to the valve body by a handle mounting member, the handle mounting member having an end face which is in a plane generally perpendicular to the valve handle, the improvement comprising an actuator mounted on the body for moving

the flush valve handle, the actuator including:

a housing having a collar with an abutment formed therein for engagement with the end face of the handle mounting member, the collar including a passage for receiving the valve

handle; and

a mounting strap releasably connected to the housing and engageable with the valve body to clamp the abutment against the end face of the handle mounting member.

45. In a flush valve of the type having a valve body with a valve handle extending therefrom, the valve handle being attached to the valve body by a handle mounting member, the handle mounting member having an end face which is in a plane generally perpendicular to the valve handle, the improvement comprising a method of mounting an actuator housing on the flush valve body including the steps of:

sliding the actuator housing over the valve handle in a direction parallel to the axis of the valve handle until the housing abuts the end face of the handle mounting member;

wrapping a mounting strap around the valve body; and

releasably connecting the mounting strap to the housing to clamp the housing to the valve body against the end face of the handle mounting member.

46. The method of claim 45 wherein the wrapping step is further characterized by pivoting the mounting strap about a hinge connecting one end of the strap and the housing.

47. The method of claim 45 wherein the connecting step is further characterized by

making a threaded engagement between a screw on one of the housing and mounting strap and a nut on the other of the housing and mounting strap.

48. In a flush valve for use in flushing toilets and urinals of the type having a valve body with a water inlet and a water outlet, valve means within the body for controlling flow between the inlet and outlet, a valve handle pivotally mounted on the valve body to operate the valve means, and an actuator mounted on the valve body for causing sensor initiated movement of the valve handle, the improvement comprising an actuator including:

a housing mounted on the valve body;

a drive train including a drive motor and having a portion positioned to contact and move the valve handle;

a battery for operating the drive motor;

a sensor mounted on the valve body and connected to the drive motor and battery to cause the application of battery power to the drive motor;

a handle assembly pivotally mounted on the housing and including a case having a drive train compartment containing the drive train and an electronics compartment containing the sensor.

49. The actuator of claim 48 wherein the electronics compartment is located such that when the actuator is mounted on a flush valve, the electronics compartment is closer to the valve outlet than the drive train compartment.